

(19) World Intellectual Property Organization  
International Bureau

Citation 5

(43) International Publication Date  
20 March 2003 (20.03.2003)

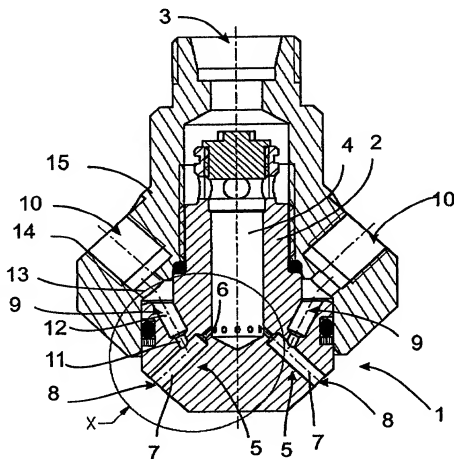
PCT

(10) International Publication Number  
WO 03/022364 A1

- (51) International Patent Classification: A62C 31/02
- (21) International Application Number: PCT/FI02/00716
- (22) International Filing Date:  
5 September 2002 (05.09.2002)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
20011787 10 September 2001 (10.09.2001) FI
- (71) Applicant (for all designated States except US): MAR-IOFF CORPORATION OY [FI/FI]; P.O. Box 25, Hakaniemi 4, FIN-01511 Vantaa (FI).
- (72) Inventor; and  
(75) Inventor/Applicant (for US only): SUNDHOLM, Göran [FI/FI]; Ilmari Kiannon kuja 3, FIN-04310 Tuusula (FI).
- (74) Agent: HEINÄNEN OY; Annankatu 31-33 C, FIN-00100 Helsinki (FI).
- (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: METHOD IN A SPRAY HEAD, AND SPRAY HEAD



(57) Abstract: A method for producing a mist in a spray head (1), especially for fire-fighting purposes or for humidification of intake air, in which method a medium, preferably an extinguishing medium, is supplied under pressure into the chamber (2) of the spray head via an inlet (3) and through at least one first channel (4) into at least one nozzle (5), which comprises at least one channel zone (6) narrower in a direction transverse to the flow of medium and after that in the direction of flow of medium a channel space (7) wider in a direction transverse to the flow of medium than the narrow channel zone, from which wider channel space the mist of medium generated is passed out of the spray head via an outlet orifice (8). The mist of medium is influenced, at least by increasing its momentum and/or reducing its droplet size, by supplying into the channel space (7) at least one second medium, preferably a gas.

WO 03/022364 A1



**Published:**

— with international search report

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## METHOD IN A SPRAY HEAD, AND SPRAY HEAD

### Background of the invention

5 The present invention relates to a method as defined in the preamble of claim 1 for producing a mist in a spray head, especially for fire-fighting purposes or for humidification of intake air, in which method a medium, preferably an extinguishing medium, is supplied under pressure to the spray head via an inlet and through at least one first channel into at  
10 least one nozzle, which said nozzle comprises at least one channel zone narrower in a direction transverse to the flow of medium and after that in the direction of flow of medium a channel space wider in a direction transverse to the flow of medium than the narrow channel zone, from which wider channel space the mist of medium generated is passed out  
15 of the spray head via an outlet orifice.

The invention also relates to a spray head as defined in the preamble of claim 7 for producing a mist, preferably for fire-fighting purposes or for humidification of intake air, comprising an inlet and a fluid path from  
20 the inlet leading into at least one nozzle, said nozzle comprising at least one channel zone narrower in a direction transverse to the fluid path and after that in the direction of the fluid path a channel space wider in a direction transverse to the fluid path than the narrow channel zone, from which wider channel space the mist of medium generated is  
25 passed out of the spray head via an outlet orifice.

A spray head according to the subject of the invention is known from an international patent application under specification number WO  
01/45799.

### Brief description of the invention

30 The object of the present invention is to create a completely new type of solution in which the average droplet size and/or penetration of the mist to be sprayed can be easily adjusted and optimized for different  
35 applications.

## 2

The method of the invention is mainly characterized in that the mist of medium is influenced, at least by increasing its linear momentum and/or reducing its droplet size, by supplying into the channel space at least one second medium, preferably a gas.

5

The method of the invention is additionally characterized by what is presented in claims 2 - 6.

10 The spray head of the invention is characterized in that the nozzle of the spray head is provided with at least one second channel for supplying a second medium into the wider channel space, causing it to mingle with mist at least partially formed in the channel space.

15 The spray head of the invention is additionally characterized by what is said in claims 8 - 11.

20 The solution of the invention has many significant advantages. By exerting an influence on the mist by supplying a second medium into the wider channel space, it is possible to significantly increase the momentum of the mist and thus to achieve a better penetration. On the other hand, with the solution of the invention, the droplet size of the mist can be substantially reduced without significantly impairing its penetration. Thirdly, the supply pressures of the mediums supplied need not be the same in comparison with each other. The nozzle of the invention has an  
25 unlimited adaptability by varying the liquid-gas ratio. In an extreme case, it is possible to supply the nozzle with liquid only, and in this case, too, mist is produced as a result. In addition to fire-fighting solutions, the solution of the invention can be used in numerous other applications. Thus, the nozzle solution can be used for humidification of intake  
30 air in various engines, such as diesel engines, or turbines.

### Short description of illustrations

35 In the following, the invention will be described in detail by the aid of an example with reference to the attached drawings, wherein

Fig. 1 presents a lateral view of a spray head according to the invention,

Fig. 2 presents the spray head sectioned along line II – II in Fig. 1, and

Fig. 3 presents a magnified detail X of the spray head in Fig. 2.

### Detailed description of the invention

Figures 1 and 2 present a spray head according to the invention. The spray head 1 comprises a chamber 2 with at least one inlet 3 for the supply of a medium, such as a hydrous extinguishing medium, into the spray head. From the inlet 3, the medium is passed via a fluid path comprising typically at least one first channel 4, such as a central channel, into at least one nozzle 5, preferably through at least one orifice 16. The nozzle 5 comprises in the direction of flow of the medium (in the direction of the fluid path) first a channel zone 6 that is narrower in at least one direction transverse to the direction of flow of the medium (to the direction of the fluid path), and after that a channel space 7 wider than the narrow channel zone, from which wider space the mist generated is passed out of the spray head 1 via the outlet 8 of the nozzle. The nozzle 5, which thus mainly consists of the narrower channel zone 6 and the wider channel space 7, is preferably disposed at an angle  $\beta$  relative to the first channel 4. The angle  $\beta$  typically has a magnitude between 0 and 90 degrees and preferably between 10 – 80 degrees, but it may even be as large as 120 degrees in some applications.

The spray head of the invention additionally comprises at least one second channel 9, which connects to the channel space 7 of the nozzle. The second channel 9 joins the channel space of the nozzle via a hole formed e.g. in a wall, preferably the side wall of the channel space 7. Into the second channel 9, a second medium, preferably a gas, can be supplied via at least one second inlet 10. In the embodiment shown in the figure, the second channel 9 comprises a narrower part 11, which connects the second channel to the channel space 7, and a second, wider channel part 12 as seen in the direction opposite to the direction

of flow of the medium (or opposite to the direction of the second fluid path from the second inlet 10 to the channel space 7). The example in the figure comprises between the second channel 9 and the second inlet 10 a chamber space 13, which connects possible other second channels 9 to at least one second inlet 10. In the embodiment illustrated in the figures, the spray head comprises two second inlets 10.

In the example presented in the figures, the spray head 1 is provided with a plurality of nozzles 5, typically distributed in a successive arrangement around the central channel 4, preferably diverged relative to each other.

The channels 7, 9 of the nozzles are typically manufactured by machining, preferably by drilling, so that they have a circular form in perpendicular cross-section. Thus, the channel space 7 of the nozzle is preferably mainly cylindrical. Naturally it is also possible to use other suitable geometries.

Fig. 3 presents magnified view of a nozzle 5 in the spray head presented in Fig. 2.

The second channel 9 forms an angle  $\theta$  with the direction of flow in the channel space 7 of the nozzle. The angle  $\theta$  is typically between 10 and 90 degrees, preferably between 20 – and 80 degrees. In some cases, the angle  $\theta$  may even exceed 90 degrees.

The second channel 9 for a medium is typically connected to a pressurized piping system used to supply a second medium into the spray head. The second medium is passed into the second medium channel 9 via the second intake 10, which can be provided with a coupling sleeve, mounted e.g. on threads 14 provided in the inlet 10, for connection to the pressurized piping. The second medium is preferably a gas. The gas is typically an inert gas, air or e.g. nitrogen. The gas may naturally also consist of a gas mixture. The gas is preferably a non-combustible gas. The gas is supplied via the inlet 10 into the second channel under pressure, e.g. from a pressure tank, such as a gas cylinder, or e.g. by means of a compressor. By supplying a gas under pressure into the

channel space 7 of the nozzle, the mist produced is subjected to a pressure effect, which on the one hand reduces the droplet size and/or increases the momentum of the droplets. As a result of this, the penetration of the mist produced is increased, and thus a solution very efficient in fire extinguishing is achieved.

The spray head embodiment presented in the figures comprises a main chamber 2, which is at least partially disposed in an external frame 15. The external frame is provided with an inlet orifice 3 for a first medium and at least one second inlet orifice 10 for a second medium. The chamber 2 is so disposed in the external frame 15 that a fluid path or a passage exists from inlet orifice 3 via the central channel 4 to the nozzles 5 and a second fluid path or a passage for the second medium from the second inlet orifice 10 via the second channel 9 into the channel space 7 of the nozzle. Between the external frame and the chamber, a preferably ring-like chamber space 13 is formed to connect the second channels 9 to at least one second inlet orifice 10.

The invention thus concerns a method for producing a mist, especially a liquid mist in a spray head 1, in particular for fire-fighting purposes. In the method of the invention, a medium, preferably an extinguishing medium, is supplied via the inlet 3 into the chamber 2 of the spray head under a high pressure and through the channel 4 into at least one nozzle 5. The nozzle comprises at least one channel zone 6 narrower in a direction transverse to the flow of the medium and after that in the direction of flow of the medium a channel space 7 wider than the narrow channel zone in a direction transverse to the flow of the medium, from which wider space the mist of medium generated is passed out of the spray head via an outlet port 8. In the channel space 7 of the nozzle, an influence is exerted on the mist of medium, at least by increasing its momentum and/or reducing its droplet size, by supplying into the channel space 7 at least one second medium, preferably a gas. According to a preferred embodiment of the method, at least one second medium is supplied into the channel space via at least one second channel 9. The first medium typically mainly consists of a liquid, such as water, or a mixture of a liquid and a gas. In a fire extinguishing solution, the medium typically consists of a hydrous extinguishing medium. The first

flow of medium is preferably deflected before it is passed into the nozzle 5. The flow of medium is typically deflected by an angle  $\beta$ . The deflection allows more effective generation of mist.

- 5 The second medium is preferably a gas, which is supplied under pressure into the channel space 7. The gas may be an inert gas, air or e.g. nitrogen. The gas may also be a gas mixture. The extinguishing medium used is typically a liquid, preferably water, in which case water mist is produced. The line pressures used in the method may vary according to  
10 the embodiment. The pressure of the first medium is typically 10 – 300 bar, preferably over 50 bar. By varying the pressure of the second medium, it is possible to influence the properties of the mist produced by the nozzle. The nozzle solution of the invention is a so-called self-suction type, which means that the spraying of the second medium in  
15 the nozzle produces a suction in the second channel 9. The nozzle of the invention will continue working fully satisfactorily even if the supply pressure of the second medium should have fallen to a minimum.

- It is obvious to the person skilled in the art that the invention is not  
20 limited to the embodiments described above, but that it may be varied within the scope of the following claims.

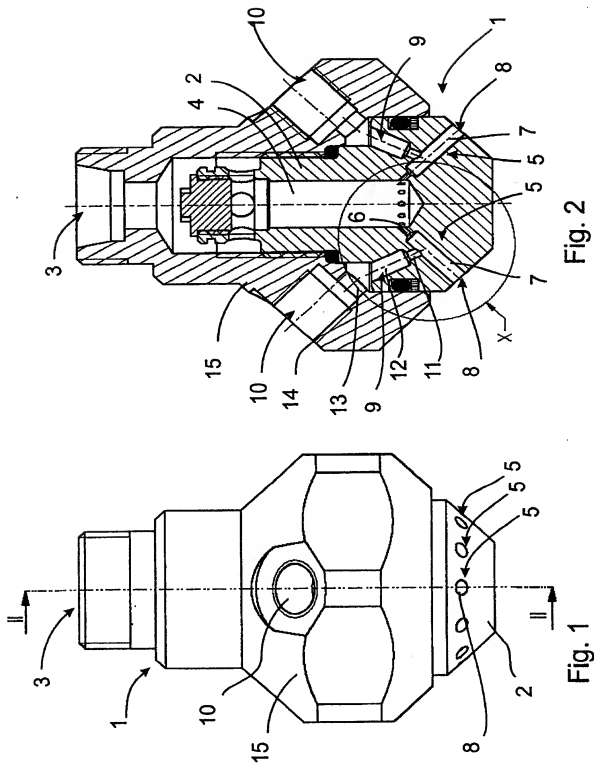


**Claims**

1. Method for producing a mist in a spray head (1), especially for fire-fighting purposes or for humidification of intake air, in which method a medium, preferably an extinguishing medium, is supplied under pressure to the spray head via an inlet (3) and through at least one first channel (4) into at least one nozzle (5), which said nozzle comprises at least one channel zone (6) narrower in a direction transverse to the flow of medium and after that in the direction of flow of medium a channel space (7) wider in a direction transverse to the flow of medium than the narrow channel zone, from which wider channel space the mist of medium generated is passed out of the spray head via an outlet orifice (8), characterized in that the mist of medium is influenced, at least by increasing its linear momentum and/or reducing its droplet size, by supplying into the channel space (7) at least one second medium, preferably a gas.
2. Method according to claim 1, characterized in that said at least one second medium is supplied into the channel space (7) via at least one second channel (9).
3. Method according to claim 1 or 2, characterized in that the first medium is a liquid, such as water, or a mixture of a liquid and a gas.
4. Method according to any one of claims 1 – 3, characterized in that the second medium is a gas, which is supplied under pressure into the channel space (7).
5. Method according to any one of claims 1 – 4, characterized in that the flow of the first medium is deflected between the inlet (3) and the at least one channel zone (6) before being passed into the nozzle (5).
6. Method according to any one of claims 1 – 5, characterized in that the flow of the second medium is passed at an angle (9) into the wider channel space (7).

7. Spray head (1) for producing a mist, preferably for fire-fighting purposes or for humidification of intake air, comprising an inlet (3) and a fluid path from the inlet leading into at least one nozzle (5), said nozzle comprising at least one channel zone (6) narrower in a direction transverse to the fluid path and after that in the direction of the fluid path a channel space (7) wider in a direction transverse to the fluid path than the narrow channel zone, from which wider channel space the mist of medium generated is passed out of the spray head via an outlet orifice (8), characterized in that the nozzle (5) of the spray head is provided with at least one second channel (9) for supplying a second medium into the wider channel space (7), bringing said second medium to contact with mist at least partially formed in the channel space.
8. Spray head according to claim 7, characterized in that the fluid path of the spray head comprises one first channel (4), the nozzle (5) being fitted at an angle ( $\beta$ ) relative to at least one first channel (4) so that the flow of medium in the narrow channel zone (6) of the nozzle is at an angle ( $\beta$ ) to the flow of medium in the first channel (4).
9. Spray head according to claim 7 or 8, characterized in that the spray head (1) comprises a plurality of said nozzles (5).
10. Spray head according to any one of claims 7 - 9, characterized in that the second channel (9) is disposed at an angle ( $\theta$ ) relative to the channel space (7).
11. Spray head according to any one of claims 7 - 10, characterized in that the second channel (9) is connected to a pressure piping system.

1/2



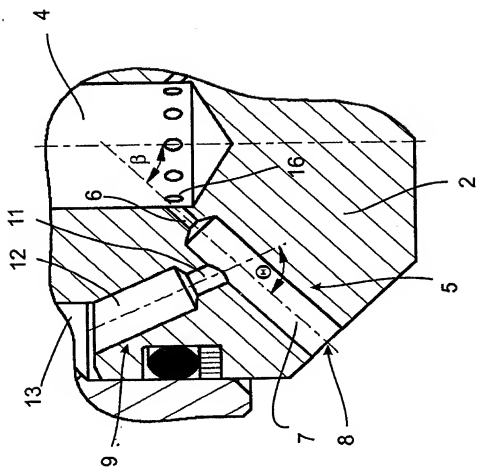


Fig. 3

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 02/00716

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A62C 31/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A62C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, PAJ, EPOQUE, FULLTEXT, INSPEC

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9801231 A1 (NAUCHNO-ISSLEDOVATELSKY INSTITUT NIZKIKH TEMPERATUR PRI MAI (MOSKOVSKOM GOSUDARSTVENNOM AVIATIONOM INSTITUTE-TEKHNICHESKOM UNIVERSITETE), 15 January 1998 (15.01.98), figures 2-3, claims 1-10 --	1,7
X	US 6223827 B1 (JURY VLADIMIROVICH ZUEV ET AL), 1 May 2001 (01.05.01), column 1, line 49 - column 2, line 17, figures 1-5 --	1-7
X	PATENT ABSTRACTS OF JAPAN & JP 2002-017883 (YAMATO PROTEC CO) 22 January 2002 (2002-01-22) abstract, see fig. 1-6, claims 1-6 --	1-11

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

\* Special categories of cited documents

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

26 November 2002

Date of mailing of the international search report

05 -12- 2002

Name and mailing address of the ISA/  
Swedish Patent Office  
Box 5055, S-102 42 STOCKHOLM  
Facsimile No. +46 8 666 02 86

Authorized officer

Beata Slusarczyk/Els  
Telephone No. +46 8 782 25 00

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 02/00716

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5520331 A (JOSEPH E. WOLFE), 28 May 1996 (28.05.96), column 1, line 45 - column 2, line 50, figure 2  --	1,7
P,X	US 6318474 B1 (GÖRAN SUNDHOLM), 20 November 2001 (20.11.01), figures 1-9, claims 1-24  -- -----	1-11

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

28/10/02

International application No.

PCT/FI 02/00716

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
WO	9801231	A1	15/01/98	AT	209970 T	15/12/01
				DE	59705677 D	00/00/00
				DK	911082 T	25/02/02
				EP	0911082 A,B	28/04/99
				SE	0911082 T3	
				ES	2169406 T	01/07/02
				PT	911082 T	28/03/02
				RU	2107554 C	27/03/98
US	6223827	B1	01/05/01	AU	732257 B	12/04/01
				AU	7352598 A	08/12/98
				JP	2001507267 T	05/06/01
				RU	2121390 C	10/11/98
				WO	9851374 A	19/11/98
US	5520331	A	28/05/96	NONE		
US	6318474	B1	20/11/01	AU	2379201 A	03/07/01
				DE	20002324 U	04/05/00
				DK	200000063 U	12/05/00
				EP	1239926 A	18/09/02
				FI	992765 A	23/06/01
				FR	2802835 A	29/06/01
				GB	0003370 D	00/00/00
				GB	2357431 A	27/06/01
				JP	2001179135 A	03/07/01
				NO	20023025 A	21/06/02
				SE	0000376 A	23/06/01
				WO	0145799 A	28/06/01